BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN RE APPLICATION OF:		Joseph J. SCHOTTLER et al.
SERIAL NO.	:	10/751,312
FILED	:	January 2, 2004
TITLE	:	METHOD OF DETERMINING AVERAGE CURRENT IN A PWM DRIVE
Group/A.U.	:	2121
Examiner	:	Sunray CHANG
Conf. No.	:	2007
Docket No.	:	P06708US0-6025

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

This is an appeal from the final rejection of claims 1-10 dated March 29, 2007.

I. Real Party In Interest:

The real party in interest of the instant appeal is Sauer-Danfoss, Inc., having an address of 2800 East 13th Street, Ames, Iowa 50010.

II. Related Appeals and Interferences:

There are no related appeals or interferences.

CERTIFICATE OF MAILING (37 C.F.R. § 1.8(a))

I hereby certify that this document and the documents referred to as enclosed therein are being eFiled or deposited with the United States Postal Service as First Class mail addressed to: Mail Stop Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 30th day of May 2007.

Timothy J. Zarley

III. Status of the Claims:

Presently, claims 1-10 are pending in this application and appear as Appendix A of this brief. Claims 1-10 are identified as the appealed claims.

IV. Status of Amendments:

No amendments have been filed or entered since the issuance of the Final Rejection on March 29, 2007.

V. Summary of Claimed Subject Matter:

Claim 1 relates to a method for driving the coil of an electrohydraulic valve 12 with a pulse width modulator drive, comprising the steps of transmitting a feedback signal 14 to a digitizing device 16 that is electrically connected to the electrohydraulic valve 12 (page 3, Detailed Description, first paragraph); sampling the feedback signal 14 within the digitizing device 16 to create a plurality of signal samples within one pulse width modulator cycle (page 3, Detailed Description, second paragraph); transmitting the plurality of samples to an accumulator 16 (page 3, Detailed Description, first paragraph); averaging the plurality of samples within the accumulator 16 to create an average value (page 3, Detailed Description, second paragraph); and transmitting the average value to a closed loop control algorithm 20 that generates a pulse width signal 22 to drive the coil of the electrohydraulic valve 12 (page 3, Detailed Description, second paragraph).

Dependent claim 7 adds the limitation to claim 1 of a method wherein the accumulator resets when the algorithm sends the pulse width signal to the coil of the electrohydraulic valve such that the method of driving the

coil of an electrohydraulic valve with a pulse width modulator drive starts over again for a next pulse width modulator cycle. (Page 3, lines 26-30).

Claim 8 relates to a method of driving a pulse width modulator comprising the steps of transmitting a feedback signal 14 from the pulse width modulator to a finite impulse response filter (page 3, Detailed Description, first paragraph); calculating an average current in the signal within one pulse width modulator cycle with the finite impulse response filter (page 3, Detailed Description, second paragraph); and generating a pulse width signal 22 in response to the average current in the signal via an algorithm 20 (page 3, Detailed Description, second paragraph).

Claim 9 relates to a method of driving the electric coil of a machine with a pulse width modulator comprising the steps of transmitting a feedback signal 14 to a digitizing device 16 that is electrically connected to the electric coil of the machine (page 3, Detailed Description, first and second paragraph); calculating the amount of average current in the coil within one pulse width modulator cycle with the digitizing device 16 (page 3, Detailed Description, second paragraph); transmitting the average current amount to an algorithm 20 (page 3, Detailed Description, first paragraph); and generating a pulse width signal 22 in response to the average current in the coil with the algorithm 20 (page 3, Detailed Description, first paragraph).

VI. Grounds of Rejection to be Reviewed on Appeal

The Examiner has rejected Claims 1-4 and 7-10 under 35 U.S.C § 103(a) as obvious over US Pat No 5,012,722 to McCormick in view of US Pat No 5,938,947 to Takano et al. and

further in view of US Pat No 6,727,832 to Melanson. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over McCormick in view of USPN 6,249,418 to Bergstrom.

VII. Argument

Rejection under 35 U.S.C. § 103(a)

Claims 1, 8 and 9

The Examiner has rejected Claims 1-4 and 7-10 under 35 U.S.C § 103(a) as obvious over US Pat No 5,012,722 to McCormick in view of US Pat No 5,938,947 to Takano et al. and further in view of US Pat No 6,727,832 to Melanson. Due to the complexity of the technology involved before providing arguments regarding non obvious Appellant will review the claimed subject matter as compared to the main reference to McCormick in an attempt to simplify the issues of this appeal.

Applicant's disclosure and McCormick both disclose devices wherein some type of controller or device (loop controller 100 in McCormick; digitizing device with accumulator 16 in the application) controls the coil of an electrohydraulic valve (54 in McCormick and numeral 12 in Appellant's disclosure) using pulse width modulation (PWM). The difference between the present disclosure and McCormick is the method used to determine the pulse width modulation. Appellant's specific method is claimed in the claims 1-10.

When reviewing McCormick the preferred method used to drive the coil (and the only such method discussed in Appellant's opinion) is discussed at Col. 7, lines 12-61 and shown in Fig. 8. The method of McCormick, as compared to claim 1 of Appellant's application, in general has a system that receives analog input signals 214A-214G that derives

from various servo loop feedback devices. (Col. 7, lines 31-37). The analog multiplexer 210 then applies a selected signal to an analog to digital converter 212. (Col. 7, lines 22-31). Specifically, based on the complexity of the servo loop program, all the feedback devices can be sampled thus allowing the electrohydraulic valve 11 to be adjusted approximately once every 1 ms. (Col. 7, lines 56-61). While teaching adjustment of the electrohydraulic valve once every 1 ms in response to a sampling of all feedback devices, McCormick does not teach this is done so within one pulse width modulator cycle.

Once the analog to digital converter 212 converts the analog signal to a digital value, the digital value is applied to a data bus 202. (Col. 7, lines 28-31). The digital value on the data bus 202 is then read by microprocessor 100A. (Col. 7, lines 27-31). McCormick does not teach that the digital value on the data bus 202 or read by microprocessor 100A is averaged in any manner.

The microprocessor 100A then sends a digital value to a digital analog converter 220 to produce a PWM excitation signal to in turn drive coil 54. (Col. 7, lines 40-46). In a preferred embodiment the microprocessor 100A is a digital signal processing device that can use formula relationships or look up data tables before sending the digital value to the digital analog converter 220. (See Col. 7, lines 47-61).

Appellant first asserts that the Examiner has not established a *prima facie* case of obviousness because a combination of the prior art references would not result in the invention as claimed. The teachings or suggestions to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicant's disclosure. See In re Vacck, 997 F.2d 488, 20

U.S.P.Q.2d 1438 (Fed. Cir. 1991); MPEP § 2143. To establish a *prima facie* case of obviousness, all the claim limitations must be taught by the prior art. In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 57 C.C.P.A. 1029, 1032 (1970).

Independent claims 1, 8 and 9, each require *inter alia* calculating or sampling "within one pulse width modulator cycle." McCormick does not teach this limitation and instead teaches that "all the feedback devices can be sampled and the position of the electrohydraulic valve 11 can be accordingly adjusted approximately once every 1 ms." (*See* '722 at Col. 7, lines 58-61). Nowhere does McCormick expressly teach the sampling or calculating of a signal '*within one pulse width modulator cycle.*'

Takano et al. does not cure McCormick, as Takano et al. likewise fail to teach the sampling or calculating of a signal '*within one pulse width modulator cycle.*' Takano et al. instead discusses the method in which an average value is calculated (*See* '947 at Col. 6, line 22-Col. 8, line 38). Takano et al. does not teach the limitation of sampling or calculating of a signal '*within one pulse width modulator cycle.*'

Melanson similarly does not cure McCormick. The Examiner points to Melanson as teaching at least one pulse width modulator stage in generating a nose shaped data stream from this pulse width modulator. Specifically, the Examiner identifies Col. 10, lines 17-31. Col. 10, lines 17-31 identifies claim 17 that states "at least one pulse width modulator stage for generating from the noise shaped data stream a pulse width recorded data stream." However, Melanson does not teach any specific limitation of the

independent claims. Specifically, claim 1 requires sampling a feedback signal within a digitizing device to create a plurality of signal samples within one pulse width modulator cycle and Melanson does not teach sampling a feedback signal within a digitizing device to create a plurality of signal samples within one pulse width modulator cycle. Instead, Melanson teaches a one pulse width modulator stage in association with a digital to analog converter.

Similarly, in claim 8 the claim limitation requires "calculating an average current in the signal within one pulse width modulator cycle with the finite impulse response filter." Melanson does not teach calculating an average current in a signal within one pulse width modulator cycle and instead only teaches a one pulse width modulator stage that generates a pulse width encoded data stream.

Again, similarly claim 9 requires "calculating the amount of average current in the coil within one pulse width modulator cycle with the digitizing device." Similar to claim 8 Melanson does not teach this limitation and instead teaches the one pulse width modulator stage that generates the pulse width encoded data stream. Consequently, a combination of the McCormick, Takano, and Melanson references will not result in a method that contains each limitation of independent claims 1, 8 and 9 and thus a *prima facie* case of obviousness has not been provided. Consequently, Appellant requests reversal of the rejection in regard to independent claims 1, 8 and 9.

Calculating or sampling within one pulse width modulator cycle provides an advantage over prior art references. Specifically, by sampling and calculating within one pulse width modulator cycle the Appellant's method controls the coil with minimum lag in order to speed up the response of

the control of a PWM cycle as is presented as an objective of this invention. Thus, not only do the prior art references not teach this limitation but additionally this limitation causes an advantage in Appellant's method over the prior art methods. Consequently, Appellant respectfully requests allowance of independent claim 1, 8 and 9.

Appellant additionally asserts that dependent claims 7 further distinguishes the prior art references cited by the Examiner. Specifically, claim 7 requires in part "such that the method of driving the coil of an electrohydraulic valve with a pulse width modulator drive starts over again for a next pulse width modulator cycle." This dependent claim further emphasizes that the Appellant's method controls the current in the coil by sampling and calculating within one pulse width modulator cycle providing the advantages discussed above. (See also page 3 of the original specification). Thus, claim 7 additionally contains a limitation that is not taught within the prior art references cited and thus a combination of these prior art references would not result in the invention claimed.

Appellant additionally asserts that combining the prior art references listed would be non-obvious without using the Appellant's specification as a blueprint. An obviousness analysis begins in the text of section 103 with the phrase "at the time the invention was made." For it is this phrase that guards against entry into the "tempting but forbidden zone of hindsight when analyzing the patentability of claims pursuant to that section. See Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 873, 228 USPQ 90, 98 (Fed. Cir. 1985), overruled on other grounds by Nobelpharma AB v. Implant Innovations, Inc., 141 F.3d 1059, 46 USPQ 2d 1097 (Fed. Cir. 1998). Measuring a claimed invention against the standard

established requires the often difficult but critical step of casting the mind back to the time of the invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and then-accepted wisdom in the field. See, e.g. W.L. Gore & Assoc., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 313 (Fed. Cir. 1983). Close adherence to this methodology is especially important in the case of less technologically complex inventions, where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against the teacher." Id.

The best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. See, e.g., C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1352, 48 USPQ 2d 1225, 1232 (Fed. Cir. 1998) (describing "teaching or suggestion or motivation [to combine] as an essential evidentiary component of an obviousness holding") (But see KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727 (2007) (warning that rigid preventative rules in regard to teaching, suggestion and motivation to combine that deny the use of common sense are not consistent with Supreme Court precedent)). Still, "the invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time." See, e.g. Interconnect Planning Corp. v Feil, 774 F.2d 1132, 1138, 277 USPQ 543, 547 (Fed. Cir. 1985)

Evidence of a suggestion, teaching or motivation to combine may flow from the prior art references themselves,

the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem solved, although the suggestion more often comes from the teachings of the pertinent references. Rouffet, 149 F.3d at 1355. The range of sources available does not diminish the requirement for actual evidence. That showing must be clear and particular. See, e.g., C.R. Bard, 157 F.3d at 1352.

The McCormick reference does not teach a step of averaging a plurality of samples or calculating an average current as recognized by the Examiner. (Final office action, page 3). Thus, the Examiner used the Takano reference to cure the McCormick reference. (Final office action, page 4). While McCormick is directed towards the operation of an electrohydraulic servo valve, Takano is directed toward a method of controlling welding current in an inverter control DC resistance welding apparatus. The McCormick reference is not concerned with welding current as McCormick solves problems associated with a servo valve. Thus, one skilled in the art would not be motivated to combine the McCormick and Takano references to arrive at the claimed invention.

Similarly, one would not be motivated to combine the McCormick and Melanson references. Again, while McCormick is directed towards and electrohydraulic servo valve, Melanson is directed toward a digital to analog converter. Melanson states, "Improved circuits and methods are required which allow continuous/time output stages to be utilized in such applications as DACs while minimizing ISI and at the same time reducing the effects of clock characteristics on circuit performance." (Col. 2, lines 4-8). (Wherein DAC is a digital to analog converter an ISI is inter-symbol interference). McCormick is not concerned with continuous/time output stages in digital to analog converters or minimizing inter-symbol

interference. Additionally, McCormick is not concerned with reducing the effects of clock characteristics on circuit performance. Instead, McCormick is directed towards an improved electrohydraulic servo valve that lowers manufacturing costs, increases reliability, repeatability and accuracy of operation. (Col. 2, lines 20-23).

Thus, one skilled in the art upon reading McCormick would not have a motivation or reason to consider the teachings of Melanson as McCormick is not concerned with continuous/time output stages in digital to analog connectors, minimizing inter-symbol interference or reducing the effects of clock characteristics on circuit performance. Therefore, Appellant asserts that there would not be a reason for one skilled in the art to combine these references without Appellant's claim as a blueprint. Specifically, there is not a teaching, suggestion or motivation within McCormick or Melanson to arrive at the combination. Additionally, Appellant asserts there is nothing implicit within Melanson or McCormick, or within the skill in the art such that common sense would dictate to one skilled in the art to make this combination. Thus, Appellant asserts that the combination of McCormick and Melanson is non obvious and respectfully requests reversal of the Examiner's rejection. Additionally, claims 2-4, 7-10 depend on claim 1 and for at least this reason are also considered in allowable form. Thus, Applicant respectfully requests reversal of the Examiner's rejection regarding claims 1-4 and 7-10.

Claims 5 and 6

Claims 5 and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over McCormick in view of Bergstrom. Appellant asserts that independent claim 1 for the reasons stated above is allowable subject and for at least this

reason dependent claims 5 and 6 are also considered allowable subject matter. Thus, Appellant requests reversal of the rejection of claims 1-10.

CONCLUSION

No other fees or extensions of time are believed to be due in connection with this response; however, consider this a request for any fee or extension inadvertently omitted, and charge any additional fees to Deposit Account 50-2098.

Respectfully submitted,

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Attachment: Appendix

APPENDIX

VIII. Claims Appendix

1. A method of driving the coil of an electrohydraulic valve with a pulse width modulator drive, comprising:
transmitting a feedback signal to a digitizing device that is electrically connected to the electrohydraulic valve;
sampling the feedback signal within the digitizing device to create a plurality of signal samples within one pulse width modulator cycle;
transmitting the plurality of samples to an accumulator;
averaging the plurality of samples within the accumulator to create an average value; and
transmitting the average value to a closed loop control algorithm that generates a pulse width signal to drive the coil of the electrohydraulic valve.

2. The method of claim 1 wherein the digitizing device is an AtoD converter.

3. The method of claim 1 wherein the digitizing device is a DSP.

4. The method of claim 1 wherein the digitizing device is a micro controller.

5. The method of claim 1 wherein the algorithm is a PI algorithm.

6. The method of claim 1 wherein the algorithm is a PID algorithm.

7. The method of claim 1 wherein the accumulator resets when the algorithm sends the pulse width signal to the coil of the electrohydraulic valve such that the method of driving the coil of an electrohydraulic valve with a pulse width modulator drive starts over again for a next pulse width modulator cycle.

8. A method of driving a pulse width modulator comprising:
transmitting a feedback signal from the pulse width modulator to a finite impulse response filter;
calculating an average current in the signal within one pulse modulator cycle with the finite impulse response filter; and
generating a pulse width signal in response the average current in the signal via an algorithm.

9. A method of driving the electric coil of a machine with a pulse width modulator comprising:
transmitting a feedback signal to a digitizing device that is electrically connected to the electric coil of the machine;
calculating the amount of average current in the coil within one pulse width modulator cycle with the digitizing device;
transmitting the average current amount to an algorithm;
generating a pulse width signal in response to the average current in the coil with the algorithm.

10. The method of claim 1 wherein the digitizing device is a finite impulse response filter.

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None